SOME AMBIGUITIES IN THE NOTION OF POWER*

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The notion of power is often said to be central to the analysis of politics. But while that analysis is a very ancient activity, the conceptual clarification of the notion of power has been undertaken only in the past generation. The reason for this discrepancy I leave to the historians of political ideas. In this introduction I merely observe that the clarification has not proceeded as far as is needed, so that we are still not at all sure of what we are talking about when we use the term. Nevertheless there is light ahead, owing especially to some formal definitions that have been offered in recent years by Shapley and Shubik, March, Dahl, Cartwright, and Karlsson. By reason of the formality of these definitions the issues of meaning have been more sharply delineated than was previously possible. Hence we have reached the point, I believe, where we may confront definitions with each other and specify precisely how they differ. In so doing we may be able to resolve some of the ambiguities remaining in the concept of power. In that hope this essay is written.

But first a personal remark: most contemporary criticism of political theory is directed, unfortunately, at the so-called giants of the past. In such an enterprise, it is not personally embarrassing—indeed it is academically fashionable and intellectually trivial—to explain where Plato went wrong or what Rousseau meant. What political theory needs, however, is criticism of contemporary theory, for this is the theory that is important in guiding political research. But such criticism may be personally embarrassing, especially when, as in this instance, it is directed at the work of men whom I regard as at the very forefront of the social sciences. I want to make it clear, therefore, that (a) I regard the theories I discuss as a great advance, one which I have in the past struggled to make and failed and (b) I utter criticism not captiously but in the spirit of contributing to the dialectic of understanding.

I. FIVE FORMAL DEFINITIONS OF "POWER"

I start with a simple statement of the basic elements of each of the five definitions, ignoring most of the subtleties of each writer's interpretations, and usually using the symbols preferred by the authors. I have also offered verbal translations of the formal definitions, translations which exhibit, I suppose, all the characteristic pitfalls of translations generally.

Shapley, a mathematician who developed his notions originally to discuss the value of n-person games, was aided in applying it to social world by an economist, Shubik.[1] Their definition relates only to the power resulting from the right to vote in a system where voting, and only voting, determines outcomes:

$$P_i = \frac{m(i)}{n!},$$

where P is the power to determine outcomes in a voting body for a participant, i, in a set of participants: $\{1, 2, \ldots, n\}$ where $m(i)$ is the number of times i is in the pivotal position and where *pivotal position* is defined thus: when the rules define q votes as winning,

$$\frac{n+1}{2} \leq q \leq n \quad \text{or} \quad \frac{n}{2} + 1 \leq q \leq n,$$

the pivot position is the qth position in an ordered sequence of the votes. (Note that there are $n!$ ordered sequences or permutations of n things.)

Manifestly,

$$\sum_{i=1}^{n} P_i = 1.$$

In words, the Shapley-Shubik definition may be stated thus: the power of a voter to determine an outcome in a voting body is the ratio of (a) the number of possible times the voter may be in a pivotal position in an ordered sequence, to (b) the number of ordered sequences possible, *i.e.*, $n!$. What this measures is thus the participant's chance to be the last added member of a minimal winning coalition, a position that is highly attractive presumably because

* I thank Professors Robert Dahl, William Flanagan, Carl Hempel, and Dennis Sullivan for criticisms helpful in improving the argument of this paper. An earlier version was delivered at the Annual Meeting of the American Political Science Association, New York City, September 1963.

[1] L. S. Shapley and Martin Shubik, "A Method for Evaluating the Distribution of Power in a Committee System," this REVIEW, Vol. 48 (1954), pp. 787–92; L. S. Shapley, "A Value for N-Person Games," *Annals of Mathematics Study No. 28* (Princeton, 1953), pp. 307–17 and "Simple Games," *Behavioral Science*, Vol. 7 (1962), pp. 59–66.

the last added winner can control the form or distribution of the winnings.

March's definition grows out of his desire, as a political scientist, to measure comparative amounts of influence, which I take to be substantially equivalent to power in his usage. In his most important paper on the subject he defines the phrase "has at least as much influence as" as a relation, I, between two roles, R_1 and R_2, each acting upon a set of behaviors, $\{B_1, B_2, \ldots\}$.[2] The effect of R_1 and R_2 each choosing a behavior is an outcome, O_{ij}, which can be pictured as a matrix, thus:

$$
\begin{array}{cc|c|c|}
 & & \multicolumn{2}{c}{R_2} \\
 & & B_1 & B_2 \\
\hline
\multirow{2}{*}{R_1} & B_1 & 0_{11} & 0_{12} \\
\cline{3-4}
 & B_2 & 0_{21} & 0_{22} \\
\hline
\end{array}
$$

Defining Ω_{hk} as the set of outcomes for a choice by R_h of B_k (*e.g.*, a row or column in the foregoing matrix), and using "m" to refer to some measure on the set of possible outcomes (*i.e.*, the set $\{O_{ij}\}$):

$$R_1 I R_2 \equiv m(\Omega_{1k}) \leq m(\Omega_{2k}).$$

Verbally: To say "R_1 has at least as much influence as R_2" is equivalent to saying "the measure on the row of a choice of a row by Role 1 is equal to or less than the measure on the column of a choice of a column by Role 2, where the row and column chosen are identical behaviors." The essential notion is that the greater the power the greater is the ability to restrict outcomes. If one cannot by one's own action lessen the range (or value of) outcomes in a situation, then obviously one has no control over the future. If one can lessen, then one can control to that degree. Hence follows the notion that the ability to restrict outcomes is the essence of influence or power.

Dahl, also a political scientist, defines power in a way closer to the commonsense tradition than either of the previous two. He says at the beginning: "My intuitive idea of power . . . is something like this: A has power over B to the extent he can get B to do something B would not otherwise do."[3] This sentence is formalized by the use of two conditional probabilities:

$$p_1 = P(B, x \mid A, w)$$
$$p_2 = P(B, x \mid A, w)$$

where (A, w) means that person A does act w; where $(A, \overline{w})$ means that person A does not do act w; where (B, x) means that person B does act x; and where $P(u \mid v)$ is the symbol for conditional probability and means the probability that, given the occurrence of event v, the event u also occurs. Thus p_1 and p_2 are statements of conditional probability. The amount of power, M, is defined thus:

$$M\left(\frac{A}{B} : w,\ x\right) = p_1 - p_2.$$

Verbally: The amount of power A has over B with respect to order w (by A) and response x (by B) is (a) the probability that, when A does w, B does x, minus (b) the probability that, when A does not do w, B does x. Clearly, this is a straightforward formalization of Dahl's intuitive idea.

Cartwright, a social psychologist, has defined power in a way quite similar to Dahl's, without, however, the use of probabilities. He relies on the notion of a "psychological force" which is a sextuple of the following:[4]

> Agents: $\{A, B, C, \ldots\}$; acts of agents: $\{\alpha_A, \beta_A, \gamma_A \ldots\}$; loci: $\{a, b, c, \ldots\}$, which may be *directly joined* if they lie on a common boundary of regions; motive bases, $\{M_1, M_2, M_3, \ldots\}$ which are drives or predispositions; magnitudes, m, which are real numbers measuring acts; and a time indicator t_r.

Quoting Cartwright, p. 191, "If we wish to indicate that force, f, has act α of agent A as its activator, need for g as its motive base, locus

[2] James G. March, "Measurement Concepts in the Theory of Influence," *Journal of Politics*, Vol. 19 (1957), pp. 202–226; see also his "An Introduction to the Theory and Measurement of Influence," this REVIEW, Vol. 49 (1955), pp. 431–51.

[3] Robert A. Dahl, "The Concept of Power," *Behavioral Science*, Vol. 2 (1957), pp. 201–15, at pp. 202–03. Note that Harsanyi has modified Dahl's definition (and also Shapley's) by adding opportunity costs. Since these modifications do not affect the basic theory, I have not discussed them here. John C. Harsanyi, "Measurement of Social Power, Opportunity Costs, and the Theory of Two-Person Bargaining Games," and "Measurement of Social Power in N-Person Reciprocal Power Situations," *Behavioral Science*, Vol. 7 (1962), pp. 67–80, 81–92.

[4] Dorwin Cartwright, "A Field Theoretical Conception of Power," pp. 183–220, in Dorwin Cartwright, ed., *Studies in Social Power* (Ann Arbor, 1959).

a as its location and ab as its direction, m as its strength, and t_k as its temporal position, we write: $f_1 = (\alpha_A, M_q, ab, m, t_k)$." Defining the strength of an act, $|\alpha_0(ab)|$, Cartwright writes:

$$|\alpha_0(ab)| = |f_{ab}| - |f_{a\bar{b}}|$$

where

$$f_{ab} = (\alpha_0, M_x, ab, m_1, t_k)$$

and where

$$f_{a\bar{b}} = (\alpha_0, M_x, ab, m_2, t_k)$$

Verbally, (f_{ab}) is a force to comply and ($f_{a\bar{b}}$) is a force to resist. Power is defined in terms of the strength of an act:

$$\text{Pow } O/P\ (ab) = |\chi_0(ab)|^{\max},$$

where χ_0 is an element of the set $\{O, t_k\}$ of acts which O can perform at t_k.

In Cartwright's words: "The power of O over P with respect to a change from a to b at a specified time equals the maximum strength of any act which O can perform at that time, where strength is specified for the direction ab in P's life space."

Finally, Karlsson, a sociologist, has defined power formally in terms of utilities.[5] Given a group of n members acting in time periods $(t_0, t_1, t_2, \ldots)$. In each time period the participants perform acts which are identified thus: $a_1(t_j), a_2(t_j), \ldots a_n(t_j)$. The outcome, x, at the end of the time period is a function, g, of these acts:

$$x(t_j) = g(a_1(t_j), \ldots, a_n(t_j))$$

For each participant there is a utility function, u_i, on the outcome,

$$u_i(t_j) = u_i(x(t_j))$$

which determines his evaluation of each outcome, x. To define the power, p, of participant i over j, assume that other participants do not act so as to influence u_i and u_j and let j choose an act to maximize u_j. Also let i choose from among his possible acts to vary u_j from a maximum to minimum, $u_{ij\max}$ and $u_{ij\min}$. Power is then defined as:

$$p_{ij} = u_{ij\ \max} - u_{ij\ \min}.$$

This may be expressed verbally: given the situation in which i can vary behaviors and hence outcomes in such a way as to vary j's reward (which is j's utility for an outcome), the power of i over j is the absolute difference between (1) the maximum reward for j from i's determination of an outcome and (2) the minimum such reward. Thus, the greater the range over which i can determine j's reward, the greater is i's power over j.

II. DIFFERENCES AMONG THE FORMAL DEFINITIONS

Even when stated verbally, these definitions have very little in common. One could not, for example, directly infer any one of them from any other one. There is a vague family resemblance between Dahl's and Cartwright's and it is possible that, with some modifications in vocabulary, they could be equated.[6] As between this pair and the others, and as among the other three individually, there is no possible equation, although the spirit of Karlsson's definition is closer to Dahl and Cartwright than to March and Shapley-Shubik. With five definitions there are at least four distinct meanings, each of which appears quite reasonable by itself.

An easy response to the discovery of these four aspects of power is to hope that there will soon be discovered a yet more general formulation which combines these four aspects neatly into one. And yet this hardly seems possible for in some very important ways these definitions are in part mutually exclusive. For example, in Karlsson's definition, power involves an ability to control the rewards to someone else, while in March's it involves the ability to control the outcomes of events. These are quite different potentials and indeed it is quite easy to imagine circumstances in which they vary inversely with each other (e.g., in n-person situations where the very ability to punish occasions coalitions against the potential punisher).

With different and contradictory meanings, even when the form of the definition has already been raised to a high level of generality, it is probably vain to hope that on an even higher level the differences and contradictions might disappear. It seems rather that we are faced with a clear instance of ambiguity which, however desirable in poetry, has no place in science or philosophy. So our immediate problem is the clarification of ambiguity, which we approach by means of a comparison of some obvious differences among the definitions.

[5] Georg Karlsson, "Some Aspects of Power in Small Groups," in Joan H. Criswell, Herbert Solomon, and Patrick Suppes (eds.), *Mathematical Methods in Small Group Processes* (Stanford, 1962), pp. 193–202.

[6] If Cartwright's force to comply, f_{ab}, and force to resist, $f_{a\bar{b}}$, could be translated into conditional probabilities of compliance and resistance, then Cartwright's definition would be exactly the same as Dahl's formula, $p_1 - p_2$.

One major difference is the size of the group to which the relation refers. Here the two extremes are Cartwright's and Shapley and Shubik's definitions; Cartwright's is specifically dyadic although at the end of his essay he expresses the hope that an n-adic definition might be constructed out of his dyadic one. On the other hand, Shapley and Shubik begin with an n-person group of voters. Their definition of power leads to a method of calculating the relative chance of each person in the system to control the outcome. Since each person's chance depends on the distribution of chances to other people, the definition is clearly n-adic. Of course, the n-adic definition subsumes the dyadic case; but its application to the dyad is trivial. In between these extremes lie the other three definitions. All three assume an n-person group, either specifically as in Karlsson's definition or inferentially (e.g., from the examples used). But in Dahl's and Karlsson's definition, the measure applied to events is dyadic, that is, it is a numerical comparison between attributes of a pair of persons or actors. Both writers attempt to extend the application to the whole group by means of exhaustive comparisons of each possible pair of participants. But this procedure simply emphasizes the dyadic character of the definition. March's definition seems somewhat closer to Shapley and Shubik than to the other three. Although he specifically defines the relation, I, as a dyadic relation between roles, still the measure on outcomes is applied to all of them, including presumably those outcomes in the n-person system that are not subject to comparison when I is evaluated for two specific roles. Thus, though the comparison is dyadic, the tools of comparison are constructed with reference to the whole set of outcomes. Because of the nature of the tools, therefore, March's definition is essentially n-adic, even though it is cast in the form of a dyadic relation.

It is not surprising that there should be confusion about the size of the group wherein power is measured, or that there should be contradictions between dyadic and n-adic definitions of power. Running throughout theory in the social sciences is a recognition of qualitative differences among one-, two- and three-unit groups. In economics, the study of price determination has sharply distinguished among monopolistic, duopolistic, and oligopolistic situations of supply. Entirely different theories have been constructed to deal with each situation. In game theory, a qualitative difference in strategic problems has been found to occur between every game of size n and every game of size $n+1$, where $n=1, 2, 3, 4$. The sharpest qualitative breaks are between one-person and two-person games and between two-person and three-person games. Two-person theory requires a different kind of mathematics from one-person theory and three-person theory requires a different set of basic definitions from two-person theory. On the other hand, three-, four-, and five-person theory can use essentially the same definitions and mathematics, although each addition of a person introduces a new kind of strategic consideration. There seems little doubt that, quite generally, there is a significant qualitative difference between dyads and n-ads. Not surprisingly, then, definitions generated with the dyadic situation in mind differ sharply from definitions generated with the n-adic situation in mind.

A second major difference among the definitions is in the postulated object of power. (This difference may well turn out to be no more than a reflection of the difference between the dyad and the n-ad, but superficially at least it appears to be independent.) At one extreme again is Shapley and Shubik's definition wherein the object of power is influence over the outcome. For them, power is measured as the chance to occupy a uniquely valuable position in the decision-making process, a position from which one can make the final determination of the outcome. This kind of power is ego-oriented in that its object is to increase utility for ego. It is essentially indifferent to others, so long as ego wins. At the other extreme is Karlsson's definition in which the object of power is, intuitively, to inflict punishment, or, stated more closely to the formal definition, to restrict the utility of someone else. For Karlsson power is other-oriented in the sense that it is concerned only with influence over another and not with an outcome. The contrast can be stated thus: ego-oriented power (Shapley and Shubik) is the ability to increase ego's utility; other-oriented power (Karlsson) is the ability to decrease alter's utility. The other definitions under consideration range themselves in between these extremes: March's is quite close to the ego-oriented extreme, since he defines power in terms of constraints on outcomes, not people. Dahl and Cartwright's definitions are, however, close to the other-oriented extreme in the sense that they measure power as an ability to force others to do one's bidding. They are not quite so extreme in tone as Karlsson's with his emphasis on punishment, but they do have an element of personal dominance, which is the essence of the other-oriented position.

The theoretical significance of the distinction between ego-oriented and other-oriented theories is not, however, that one involves manipulating people and the other involves manipulating outcomes, but rather that they differ on whether or not power always exists. In ego-oriented theories, power always exists. It cannot be eradicated for it refers to outcomes and, so long as outcomes occur, it exists. If ego runs out of power, still someone else in the n-person system has the ability to influence an outcome. So power never disappears from the system. This is especially clear in the Shapley and Shubik definition, where the sum of all participants' power is always one. Suppose, in this system, the power of i is reduced to zero. Still there exist j, k, . . . who acquire i's erstwhile power over outcomes. So no power ever disappears under the Shapley-Shubik definition, although, as circumstances change, different egos may hold it. The same is to some degree true under March's definition. Roles may change in their ability to control outcomes, but some outcome is bound to occur, by definition. Some role or roles, then, can be expected to bring it about, although any particular role may be essentially powerless. Again power cannot disappear.

Under the three other-oriented definitions, however, it is quite possible that power disappears. In both the Dahl and Cartwright measures, it is possible that power be a positive number, zero, or a negative number. (Dahl specifically recognizes this range of possibilities and I infer the same range for Cartwright from the nature of the mathematical operation in his definition.) When power is a positive number, there is no problem: it clearly exists. Similarly, there is not much of a problem when power is a negative number, for a kind of ability to influence still exists. Negative power of A over B in Dahl's (and Cartwright's) terms is not, as might be initially expected, the power of B over A but rather the degree to which A's orders occasion a kind of spite reaction in B. If B decides not to do something that he otherwise intended to do just and only because A told him to do it, then A has negative power over B. Note, however, that negative power is still a positive ability to influence. So long as A is aware of B's probable reaction of spite, he can still manipulate B into doing what he wants him to do: A merely has to order B to do exactly the opposite of what A really wants B to do and B will comply with what A really wants. Hence negative power is a version of positive power and power has not disappeared. But if power is zero, then there is nothing in the relationship. In Cartwright's definition, where power is specifically dyadic, zero power means clearly that power does not exist. In Dahl's definition, however, zero power as between A and B does not preclude power between C and D. The same is true of Karlsson's definition, so we will consider these two together.

Karlsson's definition does not initially admit of power as a negative number. But he further defines relative power, r_{ij}, which is: $p_{ij}-p_{ji}$. This could, of course, be negative and would have the natural meaning, which Dahl's does not, of a reversal in the power relationship. But Karlsson's definition, like Dahl's, does admit zero power, although, if $p_{ij}=0$, it still may be that $p_{kj}>0$. Nevertheless, there is nothing in the Karlsson and Dahl definitions that precludes the possibility that, for all i and j, $p_{ij}=0$, or that, for all A and B, $M(A/B)=0$. And this is to say that power can be non-existent.

Perhaps the contrast between the other-oriented and the ego-oriented definitions can be made clearer with an example. Let there be three participants, a, b, c, in a system and let them have equal chances to influence the outcome and no chance to influence each other. In Shapley and Shubik's definition:

$$P_a = 1/3, \qquad P_b = 1/3, \qquad P_c = 1/3.$$

In March's definition:

$$R_aIR_b, \qquad R_aIR_c, \qquad R_bIR_c.$$

In Dahl's definition:

$$M\,\frac{(a)}{b} = 0, \qquad M\,\frac{(a)}{c} = 0, \qquad M\,\frac{(b)}{c} = 0,$$

$$M\,\frac{(b)}{a} = 0, \qquad M\,\frac{(c)}{a} = 0, \qquad M\,\frac{(c)}{b} = 0.$$

In Cartwright's definition:

$$\text{Pow } a/b=0, \qquad \text{Pow } a/c=0, \qquad \text{Pow } b/c=0,$$
$$\text{Pow } b/a=0, \qquad \text{Pow } c/a=0, \qquad \text{Pow } c/b=0.$$

In Karlsson's definition:

$$p_{ab}=0, \quad p_{ac}=0, \quad p_{bc}=0, \quad p_{ba}=0, \quad p_{ca}=0, \quad p_{cb}=0.$$

The one clearly ego-oriented definition (Shapley and Shubik's) defines power in this circumstance. In a less obvious way, so does March's for, while no numerical quantity is given, it is asserted that the influence of the three participants is equal. That it is equal does not preclude that it exist. In the last three definitions, however, power is clearly non-existent. The array of zeros proves the point. So I observe that ego-oriented power preserves power in the system, while other-oriented power does not.

III. THE DIFFERENCE BETWEEN DYADIC AND N-ADIC POWER AND BETWEEN EGO-ORIENTED AND OTHER-ORIENTED POWER

The differences just pointed out in the kinds of definitions are differences in the kinds of explanations attempted by the several theories. When I speak of kinds of explanations, I have ushered in that *bête noire* of all philosophy of science, the notion of cause. And yet unpleasant as it is, we must deal with this beast for it is beauty's lover.

The thesis of this essay is that differences in the notion of cause stand back of these differences in the notion of power. Once we have straightened out some basic problems in causality, it will be simple enough to straighten out, to explain if not to reconcile, differences in the notion of power. At least two main types of notions of causality are used in social science discourse. One is a notion of marginality, the other is a notion of necessary and sufficient condition. These usually have quite distinct meanings and applications, but sometimes they run together enough to occasion some misunderstanding. It is just such a misunderstanding that is involved in the confusion about the meaning of power.

The popular notion of cause, what the word fundamentally denotes for most speakers of English, has been brilliantly explicated by Douglas Gasking, who points out the similarity between causation and recipes.[7] He observes that a basic human experience is the production of effects by manipulating nature. Any specific rule for manipulation is, he argues, a statement of cause. For example, one says "You can make iron glow by heating it," or, alternatively, "The cause of iron glowing is heat." Hence, causation generally is the notion of rules for manipulation, or recipes. Precisely, A is said to cause B, where A and B are repeatable kinds of events, if B can be made to occur by making A occur.

While the scientist wishes to use particular causes as the basis for inference, the popular notion of cause is much too confused a relation to admit much inference. There are at least two serious difficulties with it. For one thing, even the man in the street and certainly the scientist thinks of causal relations as obtaining between events that are inaccessible to human manipulation. Recipe-causality of course reflects one kind of test for the sentence "A causes B;" but one clearly does not wish to limit cause only to relations subject to this test. The more profound difficulty with recipe-causality, however, is that it takes as fixed all relevant variables except the manipulative one. Thus, to say "the monopolist's restriction of supply causes the price to rise" takes the state of demand as given, whereas in fact the level of the demand curve may itself vary independently (up or down), thus having a concomitant effect on price. If a non-manipulative variable in the antecedent condition does have a relation to the effect, then it must be involved in the cause even though recipe-causality does not admit it.

Logical confusion of this sort has rendered the popular notion of cause scientifically unusable. While most scientists have probably never successfully eliminated the popular notion from their lives or their work, still one main response to the realization of logical weakness has been a long-sustained attempt to banish the use of causality from science. The other response has been to redefine causality so that it has the same logical form as the equivalence relation and sometimes furthermore so that the two clauses have a similar temporal and spatial reference. Thus, to say "A causes B" is to say "B occurs if and only if A has occurred." From this statement the aforementioned problems of confusion in inference could never arise because the "if and only if" requirement directs attention to variables other than the manipulative one.

The usual form of the redefined notion of causality is the assertion that the cause of an event is a necessary and sufficient condition. The proof of necessity is a proof that B would not have occurred unless A occurred, and the proof of sufficiency is a proof that, if A occurs, then B occurs too.

Necessary and sufficient conditions are not recipes, rather they are full statements of all and only the antecedents required to bring about a consequent. The full complexity of the notion of necessary and sufficient condition, which often doesn't seem so difficult to prove in the laboratory, can be illustrated by a translation I have previously devised as a guide to proving sufficiency and necessity in social situations: "One event causes another if and only if the terminal situation of the causing event is identical in space-time location and in movers and actors with the initial situation of the caused event."[8]

The redefinition of causality has not, I hasten to add, eliminated the recipe kind of causality from science, especially not from social science. Most recent discussion of causality by social scientists has been fairly close to traditional usage. It has often been on a highly sophisticated level of discourse; but it

[7] Douglas Gasking, "Causation and Recipes," *Mind*, Vol. 64 (1955), pp. 479–87.

[8] William H. Riker, "Causes of Events," *The Journal of Philosophy*, Vol. 55 (1958), pp. 281–91. This essay depends for its terminology on my "Events and Situations," *The Journal of Philosophy*, Vol. 54 (1957) pp. 57–90.

has shared the recipe character with popular discourse. Thus Herbert Simon, whose work on this subject is cited with approval by March, argues in one essay that cause is the highest order variable in a set of equations, without enquiring into whether or not the set of equations contains all the relevant variables.[9] To take his simplest example: "poor growing weather→small wheat crops→increase in price of wheat," wherein the first phase is said to cause the second and the second the third. All this, of course, assumes that the demand for wheat, not included in the system of equations, is stable and that it does not "cause" the price. Instead, the cause is said to be a marginal effect on the state of supply, something on which a low price of wheat can be blamed.

The difference between the two kinds of causality is, like the difference among definitions of power, a difference in orientation toward outcomes. In recipe-like causality, the full explanation of the effect is not the problem. Rather the problem is to explain how the effect can be made to occur. If no manipulative technique is available, cause may be non-existent.[10] By contrast, in the necessary and sufficient condition kind of causality, the center of attention is on the effect rather than on manipulative techniques. Here the full explanation of the outcome is at stake. Hence, cause cannot be non-existent, although it can be unidentified.

Thus there is a direct parallelism (a) between ego-oriented power and necessary-and-sufficient-condition causality and (b) between other-oriented power and recipe causality. It is not surprising that this parallelism exists, for power and cause are closely related concepts. Power is potential cause. Or, power is the ability to exercise influence while cause is the actual exercise of it.

This parallelism is clearest in Karlsson's and Shapley and Shubik's definitions. Karlsson's power is clearly based on a recipe notion of causality. Not only is it concerned exclusively with ego's ability to restrict alter's utility, a wholly manipulative concern; not only is his power non-existent in the absence of manipulation or the will to manipulate; but also his definition of the measure of the motivation to use power is proportional to the amount of power possessed. It is postulated thus that the desire to manipulate increases with the ability to do so, an assumption about which we have no convincing empirical information one way or another. In short, Karlsson's power is a direct reflection of recipe causality. Conversely, Shapley and Shubik's is close to a direct reflection of necessary and sufficient condition causality.[11] Since the Shapley-Shubik definition of power, though stated in terms of individual opportunities to manipulate, involves the calculation of all possible opportunities to influence, the total picture presented is the distribution of the chance to manipulate among all participants. When the potential becomes actual we have a necessary and sufficient condition for outcomes. At no point in the analysis does power or cause cease to exist.

The parallelism in the other three definitions between kinds of power and kinds of cause is not so clear as in the two just mentioned, largely, I think, because of confusion engendered by the contrast between dyadic and n-adic situations. Probably the popular idea of power is similar to what Dahl calls his intuitive idea; perhaps it is even simpler, like Karlsson's intuitive idea, being merely the ability to inflict punishment on somebody. There is certainly a highly dyadic feature to punishing somebody or making somebody do something. Hence, in attempting to capture the popular and intuitive idea, there is a strong tendency to think of power as dyadic and to define it that way.

Once the notion of dyadic power is accepted there is also a strong tendency, I believe, to accept a recipe notion of cause. In the dyadic relation, especially when one actor is aggressive and the other passive, which is the usual situation in which men want to talk about power, it is very easy to see the recipe for action: "A uses his power over B." The recipe is at hand and may thus be used. Furthermore, even to those trained to look for necessary and sufficient conditions, the recipe itself looks like such a condition. Of course, it is not and cannot be, for another necessary condition is that B exist. Nevertheless, such background, non-marginal conditions are easy to overlook in the dyad. Hence follows the acceptance of recipe causality and other-oriented power.

The interesting, perhaps even astonishing thing about the March, and Dahl, and Cartwright definitions is the degree to which they have struggled away from the kind of power and causality suggestively imposed by the dyadic situation they purport to describe. March is the one who struggled most success-

[9] Herbert Simon, *Models of Man* (New York, 1957), chap, 1, 3.

[10] G. J. Warnock, " 'Every Event Has a Cause' " in Anthony Flew, ed., *Logic and Language,* Second Series (Oxford, 1953) p. 101 ff.

[11] But see the addendum of this paper for evidence of a manipulative element in their definition.

fully. He retains the dyadic form of power, but he manages to import a large amount of ego-oriented power into it, so much so that previously I classified his theory as n-adic and almost ego-oriented. As noted, it is his emphasis on a measure over outcomes that turns his theory away from the dyad and the alter-oriented. And the emphasis on outcomes represents an approach to necessary-and-sufficient-condition causality, inasmuch as an explanation of outcomes tends toward total explanation rather than manipulative explanation. It seems to be that March started out with an other-oriented power and a recipe causality; but, as a scientist seeking complete explanations rather than manipulative techniques, he was driven toward the ego-oriented power and necessary-and-sufficient-condition causality. As a result there is a fundamental ambiguity in his definition, deeper perhaps than in any of the other writers under consideration—and for that reason more deserving of praise for scholarly integrity.

The same struggle March went through is also reflected in Dahl's and Cartwright's definitions, but in a different way. Both restrict the application of their measure: Dahl by requiring that it always be used in connection with a survey of the source, means, amount, and range of power; Cartwright by incorporating substantially these restrictions into his definition. I interpret these restrictions on an essentially manipulative theory of power that assumes an essentially manipulative theory of cause as an attempt at a total explanation and hence as an attempt at a necessary-and-sufficient-condition theory of cause. Of course, ambiguity results.

XI. CONCLUSION

Thus some fundamental ambiguities among definitions of power and inside particular definitions have been shown to reflect—and to root in—similar ambiguities about the nature of causation. Other writers, I hasten to add, have discussed the same ambiguities. Bachrach and Baratz, brilliantly criticizing Dahl's empirical work which uses a somewhat more directly manipulative definition than the theoretical definition discussed here, pointed out that a manipulative theory is far less than a complete explanation.[12] Similarly, Singer has recently observed the absence of reciprocity in power, as it has here been defined. This absence seems to me to be a function of the search for manipulative skill rather than a total explanation.[13] But I have in this essay shown that these ambiguities are not accidental features of a particular definition, but are rooted in the very conceptions of power and causality themselves.

The final question, once the full complication of the ambiguities is revealed, concerns the appropriate scientific attitude toward the conception of power itself. Ought we redefine it in a clear way or ought we banish it altogether? My initial emotion, I confess, is that we ought to banish it. But this suggestion will, I am sure, find little sympathy among my colleagues. Alternatively, I suggest minimally that each definition specify clearly the kind of theory of cause it reflects. Undoubtedly there are many kinds of situations in which one wants to investigate other-oriented power relations and recipe causality (*e.g.*, "how can the President control Congress?"); but these investigations should be clearly labelled as not likely to lead to total explanations. Beyond that I suggest that the customary definition of power be revised in the ego-oriented direction to reflect the necessary-and-sufficient-condition theory of causality. Only then will the notion of power reflect the totality of the situation it purports to describe. The Shapley-Shubik definition, which has this character, is, unfortunately, limited to committee-like situations and is not therefore general enough. What we need is a definition of power in the spirit of their definition, and applicable to a wider range of situations. But that is the subject of another paper.

ADDENDUM

There is a manipulative element in the Shapley-Shubik definition even though it is not immediately apparent. To show its existence I will construct a quite general definition of power with a necessary and sufficient condition notion of cause underlying it and then consider what is necessary to translate this more general definition into Shapley's and Shubik's.

Let there be a set of $\{1, 2, \cdots, n,\}$ participants and let $\{0_i\}$ be the set of outcomes, $i=1, 2, \cdots, m$ and let $\{A_{1i}, A_{2i}, \cdots, A_{ni}\}$ be the set of actions to bring about 0_i by a set of participants. Assume no A_{ji} alone is sufficient and some, but not necessarily all, A_{ji} are necessary for 0_i.

Let

$$v(A_{ji}) = 0, \text{ if } A_{ji} \text{ is not necessary}$$

$$v(A_{ji}) = 1, \text{ if } A_{ji} \text{ is necessary.}$$

[12] Peter Bachrach and Morton Baratz, "Two Faces of Power," this Review, Vol. 56 (1962), pp. 957–52.

[13] J. David Singer, "Inter-nation Influence," this Review, Vol. 57 (1963), pp. 420–30.

Then, for $j \neq k$,

$$P_j > P_k \equiv \sum_{i=1}^{m} v(A_{ji}) > \sum_{i=1}^{m} v(A_{ki}),$$

where P_j and P_k are indices of the power of participants. Applying this definition to a simple majority voting body of $\{a, b, c\}$, where weights are $w(a)=50$, $w(b)=49$, and $w(c)=1$, then A_a is necessary (*i.e.*, is included in a minimal winning coalition) in six instances out of a possible six, A_b in four, and A_c in four. Thus, out of 14 necessary memberships, $P_a=3/7$, $P_b=2/7$, $P_c=2/7$, which is different from the Shapley-Shubik result.

To render the results identical let $u_j(O_i)$ be the utility of an outcome, O_i, for participant, j. Then, let

$$P_j = \sum_{i=1}^{m} u_j(O_i)v(A_{ji}); \text{ and let } \sum_{j=1}^{n} P_j = 1.$$

In the particular case of the Shapley-Shubik power index, let $u_j(O_i)=1$, if j is pivot, and let $u_j(O_i)=0$, if j is not pivot. In the example cited, it is now the case that $P_a=2/3$, $P_b=1/6$, $P_b=1/6$, which is the Shapley-Shubik result. I conjecture that it is generally true that the Shapley-Shubik definition can be derived from the definition here set forth by a utility function for pivoting. If so, then the Shapley-Shubik definition with its apparent emphasis on outcomes contains a manipulative element, although the thing manipulated is outcomes, not people. Nevertheless, to the extent manipulation is involved, a recipe-like notion of cause has contaminated the fundamental notion of explanation, which is that of a necessary and sufficient condition, underlying their definition.